PANORAMA DRAWING

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HUGH REES, LTD., 119 PALL MALL, S.W.

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PANORAMA DRAWING

FROM NATURE AND FROM MAPS,
WITH NOTES ON DRAWING A CONTOURED
SKETCH FROM A PANORAMA

Capt. P. E. LEWIS, R.F.A.

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1908

Price One Shilling and Sixpence net

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PANORAMA DRAWING

FROM NATURE AND FROM CONTOURED MAPS.

The object of this pamphlet is not to detail the various methods by which panoramas may be drawn, but to describe a simple and practical method by which those who are not naturally proficient in landscape drawing may be able to produce a useful and accurate panorama, either from nature or from the map.

Simplicity and rapidity being considered of great importance, calculations have been avoided wherever possible.

The question of perspective has not been touched upon. Since the positions of all the main lines of the panorama are found by measurement, a knowledge of the rules of perspective is not absolutely necessary. In drawing detail, such as houses, correct perspective, though improving the appearance of the panorama, does not add to the military information it conveys. Such detail can be shown sufficiently clearly by conventional methods. A knowledge of the rules of perspective, which can be found in any book on drawing, will, however, enable the sketcher to work with fewer measurements, and thus to work more rapidly.

TO DRAW A PANORAMA FROM NATURE.

Before beginning to draw a panorama it is necessary to decide on the scale at which it is to be drawn. This is usually limited by the width of the paper which is available to draw it on. Hold the paper in front of the eye at such a distance that it just covers the extent of country which has to be drawn. It is clear that by moving the paper nearer to the eye more ground is covered, and the scale of the picture that can be drawn on the paper becomes smaller. The scale therefore depends on the distance of the plane of the picture from the eye ; this distance of the picture-plane will be referred to as the 'distance.'

In order to get a correct outline of the panorama, the positions of important objects must be fixed by measurements, taken with a ruler or pencil, held at this 'distance' from the eye. The accuracy of the panorama will depend to a great extent on this 'distance' being correctly preserved, and the simplest method for so doing is as follows :—

Take a plotting scale or any long ruler with clearly marked divisions about quarter of an inch apart. Fasten a piece of string to the centre of the ruler, and make a knot in the string at the required 'distance' from the ruler. By holding this knot between the teeth, the ruler is kept at the correct 'distance' from the eye. It is important to see that the ruler is approximately at right angles to the string, when taking a measurement. Any measurements taken in this way can be transferred direct to the paper, and the result will bring the panorama to the scale required.

To start the panorama it is best to choose some central point, and fix by measurement the position of all important objects to the right and left of it. This will give their lateral position on the paper. To find their vertical position, the ruler can be used as before, but held vertically, and the only difficulty is to find some horizontal, or nearly horizontal, line to measure from. It will usually be found that there is a road or fence in the foreground, which forms a horizontal line to serve as a basis for measurements. If so, this line should be drawn first, and the heights of other objects measured above and below it. If such a natural horizontal line cannot be found, an imaginary line can be taken as follows:—Holding the ruler at arm's length, as nearly horizontal as can be judged, find three or four prominent objects which are on the same level. Take the line joining these points as the basis of measurement, and draw a line on the paper to represent it.

If a clinometer or Abney's level be available, the heights can be quickly measured in the following manner :—

Draw a horizontal line across the paper to represent the horizon line. Now take the slope to any object which requires fixing. If the slope is zero, the object lies on the horizon line. For every degree of slope up or down, the position on the paper will be one-sixtieth of the length of the 'distance' above or below the horizon line. Thus for a twelve-inch 'distance' each degree of slope will place the object one-fifth of an inch from the horizon line.

It will save time if a scale showing fifths of an inch (when using a twelve-inch 'distance') be made on the edge of a slip of paper, so that the position of each object can be quickly plotted.

It is not necessary, unless the panorama is very complicated, to fix a great number of points. Two or three points along the distant sky-line and the position of important features of the ground are all that are required. When the main outlines are drawn in, the minor detail will be found to fit easily into its proper place.

Having fixed by measurement the important points, the outline of the panorama must be drawn in. It is far better to draw the outline in carefully before attempting to draw any detail. The most important lines, and those which require to be most carefully drawn, are the distant sky-lines and the outlines of hills and spurs. Remember that the distance must be drawn carefully if it is to be at all accurate. A little error in height in the distance will affect the accuracy of the panorama a great deal, while a similar error in the foreground would be quite immaterial.

After having drawn in the outline of the hills and spurs, put in the more important detail, still only in outline, such as woods, rivers, roads, &c. When this has been done, the panorama should be examined as a whole, and any inaccuracies corrected before finishing up.

Plate 2 shows a panorama at this stage.

This finishing up is the real difficulty to a great many who have had little practice in drawing from Nature. The following hints are intended to simplify the process as much as possible :—

1. Do not try to show too much. A great deal of the detail which can be seen is not of military importance and would be out of place on a panorama, even if it could be drawn. A panorama which shows clearly the position of hills, roads, rivers, woods, villages and railways has a great deal of military value, which would be to a great extent obscured by putting in all the minor detail, such as fences, crops, or individual trees and houses. Of course cases will occur when such minor detail is of importance and cannot be left out, but as a general rule the gain in clearness will more than compensate for their

omission. Section 79 paragraph 4 of the Manual deals with this question of what can be omitted.

2. The simplest way to put in woods is to draw the outline of the tree-tops with a succession of short curves, then draw a line to show the near edge of the wood, and fill in the space between with simple diagonal shading. This is the only shading which is required in the panorama, and the result is that the woods stand out among the other detail and can be recognised at once.

Villages may be shown by drawing a series of conventional houses, with little strokes and dots to represent the chimneys and windows. So long as the result is sufficient to indicate a collection of houses, the detail is not of great consequence.

Roads are best shown by two lines representing the edges, which get closer together as the road recedes, until in the distance they become a single line. Rivers and streams are difficult to show clearly, and it will be found of great help to colour them with blue chalk whenever they are likely to be mistaken for roads or fences. In the same way, roads may be coloured brown when there is likely to be any doubt about them.

Examples of woods, villages, roads, and streams are to be found in the panorama shown in Plate 3.

3. One of the most important points in finishing up

is to make a difference between the distance and the foreground. A panorama, even when quite accurately drawn, will appear flat and unreal from neglect of this point. The distance should be drawn with thin, faint lines, using a hard pencil, while the foreground is put in boldly with strong strokes, using a softer pencil. The middle distance should get fainter as it gets further away. The easiest way to do this is to use two or three pencils, say HH, H and HB, but with a little practice a sufficient difference can easily be made with a good H pencil, such as a Kohinoor H. It is this graduating of the different distances which is one of the difficulties of working in ink, where all the lines are of the same depth of shade. The disadvantage of a pencil drawing, which is its liability to get smudged, can be overcome by avoiding too soft a pencil, and, if necessary, by washing over the drawing with milk or a weak solution of gum.

4. How to treat the immediate foreground is often a difficulty, and much time is sometimes wasted in drawing the objects which present themselves, such as bushes, cabbages, &c., though they have no military importance, and do not add to the useful information given by the panorama. The value of the foreground lies in two things: first it helps to throw back the distant parts of the panorama; secondly, it shows the shape of the ground in the immediate front. The first result is

obtained by drawing the foreground in strong, black touches, whatever the objects drawn may be.

The second result is best obtained by drawing imaginary furrows, as though the foreground were a ploughed field, with the furrows running straight to the front.

If the ground in the foreground is level, these furrows must be drawn converging towards a point on the horizon line. If the foreground slopes up, they will converge to a point above the horizon line. If it slopes down, which will usually be the case, the furrows will converge to a point below the horizon, and the steeper the ground the further from the horizon will be the point of convergence. To draw the furrows, fix on the point of convergence and rule a few faint lines to guide the eye, then draw them in freehand with bold strokes in the near foreground, diminishing in strength as they recede. (*See* Plate 3.)

The drawing of the panorama being finished, the addition of the following information is necessary to complete it:—

1. Draw a vertical line down to each important object in the panorama, and along this line print the name of the object and its range in yards. If the names are taken from a map, the name of the map should be stated. State how the ranges were obtained.

2. State underneath the panorama the position from

which it was drawn and the direction of view. The position can be described in three ways:

(*a*) By a reference figure on the sketch, if a sketch is attached to the panorama.

(*b*) By reference to a map, the name of the map being stated.

(*c*) By drawing a rough sketch, in plan, of the surroundings.

The compass directions should also be printed, above the panorama, in their correct positions.

3. Signature and date should be placed in the right hand bottom corner. The 'distance' used may also be stated.

NOTE.—For artillery purposes it is useful to show on the panorama the lateral angles between different objects. This can be done by drawing parallel, vertical lines across the panorama at intervals of one-sixtieth of the 'distance.' The lateral angle in degrees between any two objects is shown by the number of intervals between them, each interval representing one degree. To show angles of sight on the panorama, horizontal lines may be drawn at the same interval of one-sixtieth of the 'distance.'

These lines will only be of use when the guns occupy the position from which the panorama has been drawn.

TO DRAW A PANORAMA FROM A MAP.

(*See* Plate 2.)

Suppose that A is the point from which the panorama is to be drawn. Draw a line A D on the map in the required direction of view. On each side of A D set off lines A B, A C, each making an angle 30 degrees with A D. The angle B A C is then 60 degrees, and contains everything which can be seen from A when looking in the direction A D.

Now decide on the distance of the picture-plane from the eye. The longer the 'distance' the larger will be the panorama, and as it is easier to draw the detail on a fairly large scale, it will be advisable to have the 'distance as long as possible.

Draw A B, A C, as long as the chosen 'distance,' and join B C. Then B C is the extent of the panorama. As A B C is an equilateral triangle, the length of B C is equal to the 'distance,' and as B C is limited by the length of the paper on which the panorama is to be drawn, the 'distance' is also limited to this length. On foolscap or Army Book 4 (for examinations) 12 inches is the most suitable 'distance.'

If B C falls off the map, which is the most convenient case, pin the map to the paper so that B C falls about half-way up the paper. B C now represents the horizon line of the panorama, and all points which, on the map, are on the same level as A will lie on the line B C on the panorama.

To fix the position of any point on the panorama two things have to be considered :—

(1) Its position laterally, *i.e* to the right or left of A D.

(2) Its position vertically, *i.e.* above or below the horizon B C.

The lateral position is obtained by placing the edge of a ruler through A and the object on the map ; the point E, at which the ruler cuts B C, gives the lateral position on the panorama. (*See* Plate 2, where the dotted line shows the construction for fixing the corner of the wood.)

It is convenient to stick a pin in A so that the ruler can be rapidly brought into position against the pin when fixing many points.

If B C falls on the map, the lateral positions obtained must be transferred with a pair of dividers to the horizon line on the paper.

Now, if the object to be drawn is not at the same height as A, it is necessary to find its vertical position above or below the point E, which has just been found.

The vertical position of the object on the panorama is dependent on the angle of sight to the object from A.

Suppose that the angle of sight is one degree depression, then the line of sight will have fallen one inch below the horizon at 60 inches distance from the eye, or one-fifth of an inch in 12 inches distance. If then the picture plane is 12 inches from the eye, the line of sight cuts it one-fifth of an inch below the horizon line.

Thus on a panorama drawn with a 12-inch 'distance,' each degree of elevation or depression places the object one-fifth of an inch above or below the horizon line.

The angle of sight to any object is obtained from the formula :—

$$D = \frac{\text{V.I.} \times 20}{\text{H.E.}}$$

In practice this need not be worked out accurately, but a rule of thumb can be made to suit the V.I. of the map, *e.g.* with contours at 50 feet V.I.

Multiply the contour difference by ten and divide by the number of hundreds of yards in the range.

A much quicker method of finding the angle of sight, and one which avoids all calculations, is to draw a scale by means of which the angle of sight to any point of known height can be read off.

Such a scale is shown in Plate 1. It is used as follows :—

Place the scale on the map so that its edge touches A and the point P to which the angle of sight is required, A being exactly opposite the point of convergence of the diagonal lines, which represent degrees of slope. Now see from the map what is the difference in level between A and P. Suppose it to be 200 feet. Run the eye along the 200-foot line till it reaches a point exactly opposite P. The position of this point with reference to the diagonal lines of slope gives the angle of slope from A to P. In the example shown on the Plate, the point opposite P on the 200 line lies midway between the lines of 1 degree and 2 degree slope ; therefore the angle of sight from A to P is 1½ degrees.

The scale shown on the plate is drawn for a map of 1 inch to a mile, but it can be used equally well for other scale maps by observing the following rules :—

When drawing a panorama with a 12-inch ‘distance’ from a map at 1 inch to a mile, each degree of slope is equal to a distance of one-fifth of an inch from the horizon. From a map at 2 inches to a mile, each degree of slope is equal to a distance of two-fifths of an inch from the horizon.

In practice, having made a scale with divisions of fifths of an inch—

1 division will represent a degree when using a 1-inch map.

2 divisions will represent a degree when using a 2-inch map.

$\frac{1}{2}$ a division will represent a degree when using a $\frac{1}{2}$-inch map.

To construct the scale shown on Plate 1, draw a series of ten parallel and equi-distant straight lines and number them 50 100, 150, &c., beginning from the lowest line, which should be at the same interval from the edge of the paper. On the edge of the paper, under the left ends of these horizontal lines, mark a point to serve as a starting point, and from it draw a vertical line cutting the ends of the horizontal lines.

On the line marked 500, mark off the H.E. for 500 feet at a 1 degree slope, at a scale of 1 inch to a mile. Draw a line through the point thus found and the starting point, and figure this line 1 degree. Mark off the H.E. for 2 degrees in a similar way, draw the line as before and figure it 2 degrees. Each H.E. must be measured from the vertical line on the left.

This scale takes rather a long time to draw, but an excellent one can be made with very little trouble on the ordinary service protractor. The horizontal lines of the diagonal scale of inches serve for the lines of vertical interval. The lines of slope are calculated for as explained above, and are drawn in as shown in Plate 1. The scale thus drawn on the protractor is always at hand when required. The only disadvantage is that the length available is not very great, but it would usually be found sufficient for working on a map of 1 inch or ½ inch to the mile.

It will be found to save time if a little nick be made in the edge of the protractor at the starting point. Then if a pin be stuck in the point A on the map (as already advised) the pin will catch in this nick and much time will be saved in adjusting the scale.

To draw the panorama, begin by fixing a few points along the tops of hills and spurs. Join up these points by eye, so as to get the outlines of the hill features. It is best to begin with the nearer hills, because these may hide more of the distance than is expected. When the outline of the nearer hills has been drawn, the angle of sight to the more distant features will give their height above the horizon line, and will show whether they appear above the hills already drawn. This should be tested at points where the distance is most likely to appear, that is where the distant hills are highest, or where there are depressions in the nearer ridges.

When the outlines of the hills have been drawn, put in the roads, rivers, &c., and finally the smaller detail, such as houses, woods, &c.

With regard to the size of such detail, it is useful to remember that 50 feet, which is the average height of a house or tree, will subtend an angle of 2 degrees at 500 yards range; an angle of 1 degree at 1,000 yards range; an angle of ½ degree at 2,000 yards range, and so on.

With regard to finishing up, see the notes on drawing a panorama from nature, which apply equally to drawing from the map.

TO DRAW A CONTOURED SKETCH FROM A PANORAMA.

First Case.—When the panorama contains no further information than the ranges to prominent objects. (This was the case in the Staff College Entrance Examination Paper, set in August, 1906.)

Draw a horizontal line B C anywhere across the panorama to represent the horizon line, extending to the limits of the panorama.

On B C describe an equilateral triangle A B C inverted; then the apex A represents the position of the observer on the sketch. This is got by assuming that the panorama represents all the ground included in an angle of 60 degrees from the point of view, which is the usual extent of a panorama.

The scale of the sketch, if not given, is now chosen to suit the size of the paper, and the position of every object of known range is marked on the sketch. To do this, drop a perpendicular to the horizontal line B C from some object on the panorama which is marked with a range. From the point E, where this perpendicular cuts B C, draw a line to A. The position of the object on the sketch lies on the line A E and at a distance from A equal to its range measured at the scale of the sketch.

The position of all the marked objects having now been fixed in a similar manner on the sketch, the remaining details (roads, woods, &c.) must be put in by estimating their relative positions.

Finally the contours (or rather form lines) are put in.

Under the given conditions it is not possible to estimate the actual height of any point on the panorama. All that can be done is to give an approximate idea of the shape of the ground. First mark the position of all watercourses that can be seen. This is most important, and greatly facilitates the drawing of the form lines. It is also of assistance to draw in the position of the crests of any spurs or ridges that can be seen.

Then draw in the form lines, at first very lightly in pencil, as alterations will probably be necessary before they can be fitted in. It will usually be best to begin by drawing the lowest form line, making it bend on each watercourse and spur. Then put in the form lines to represent the tops of the hills.

It must be remembered that the highest hills are not always those which appear highest in the

> panorama, for, if two hills are actually of equal height, the nearer one will appear higher in the panorama; conversely, if two hills appear of equal height in the panorama, the more distant one is actually the higher.

Having put in the lowest and highest form lines, interpolate intermediate ones, being careful to show the difference between convex, uniform, and concave slopes. The nature of the slope can easily be seen where spurs are shown in profile. The number of form lines interpolated and the V.I. chosen should correspond with the rule given in the Manual for choosing a V.I. which is dependent on the scale of the sketch.

Finish up the sketch by numbering the form lines from any assumed datum level. Draw a scale of yards and a North point, which is obtained from the direction of view stated on the panorama.

SECOND CASE.—When ranges are given and also the position of the horizon line is given or can be found.

> N.B.—A point on the horizon line can be found by producing any two lines on the panorama which represent parallel horizontal lines in nature, *e.g.* the ridge and eaves of a roof. The horizontal line drawn through the point where such lines converge is the horizon line.

Draw the horizon line B C and find the position of A as in Case I. Then, since the 'distance' of the panorama is known (*i.e.* the length of A B or A C) the height, relative to the observer, of any object of known range can be found by measuring its distance from the horizon on the panorama. For example :

On a panorama having a 'distance' of twelve inches, the top of a hill, of which the range is 400 yards, is one inch above the horizon line. With a 'distance' of twelve inches, one inch represents an angle of sight of five degrees, therefore by the formula : $20 \times \text{V. I.} = \text{H.E.} \times \text{D.}$

$$\text{V.I.} = \frac{400 \times 5}{20} = 100 \text{ feet.}$$

The hill in question is therefore 100 feet above the observer.

This calculation may be avoided by using the 'scale for reading angles of sight,' shown on Plate 1. On the panorama, draw lines parallel to the horizon line at intervals equal to one-sixtieth of the 'distance.' The angle of sight to any object on the panorama is shown by its position with regard to these lines, which represent degrees of slope above or below the horizon. The angle of sight and the range to any object being known, its height above or below the observer can be read off the scale.

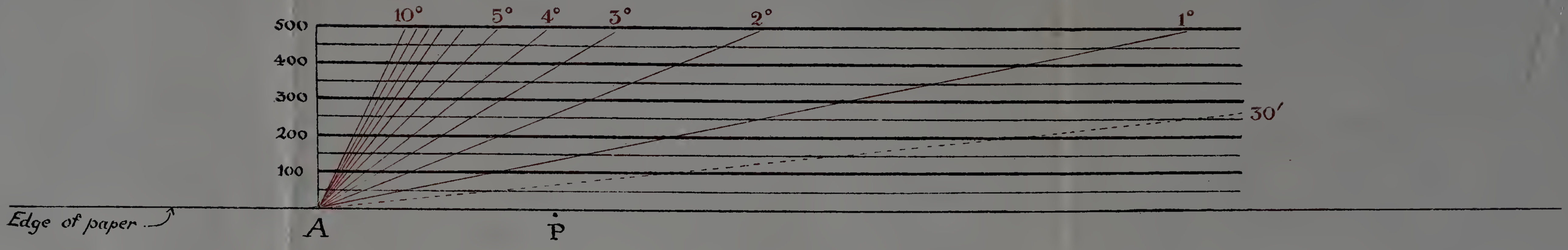
In drawing the sketch, assume any convenient height for A, and determine the height of each object of known range.

The form lines can then be drawn to correspond with these heights. All else is drawn as explained in Case I.

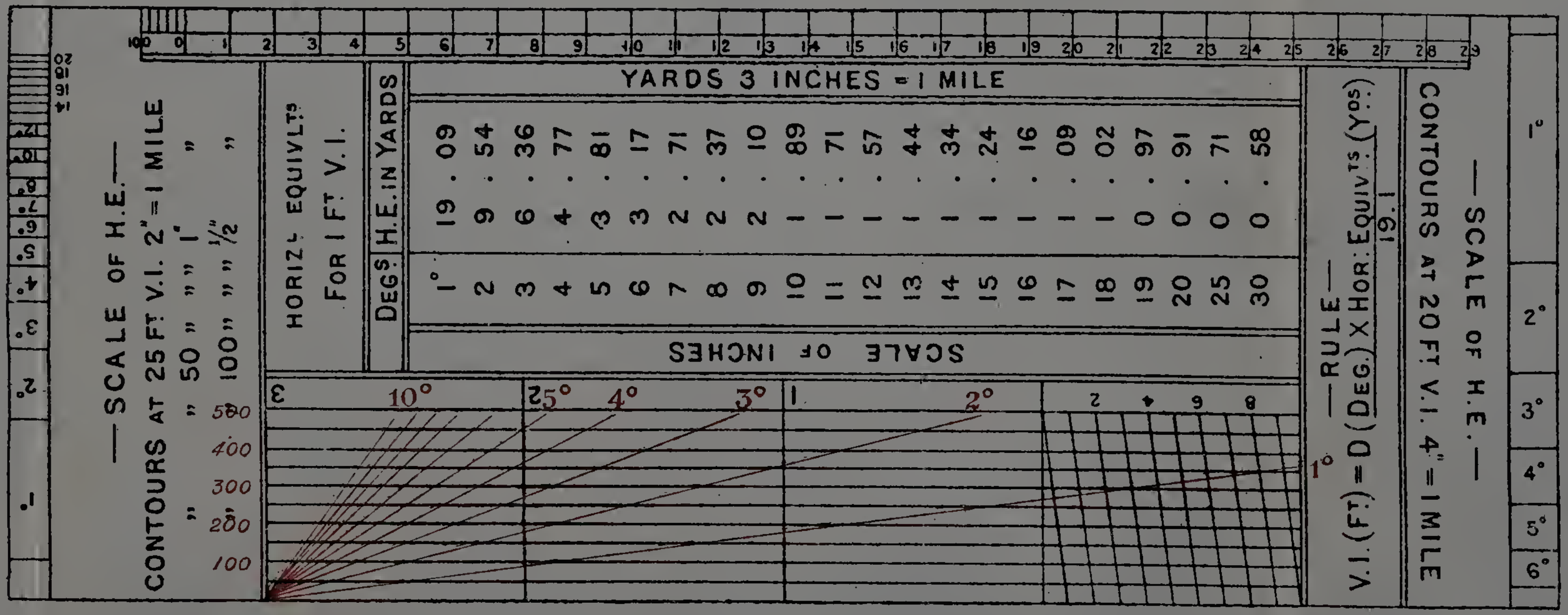
Spottiswoode & Co. Ltd., Printers, New-street Square, London, E.C.

Scale for reading angles of sight from a contoured map.

Drawn for map of 1 inch to a mile.

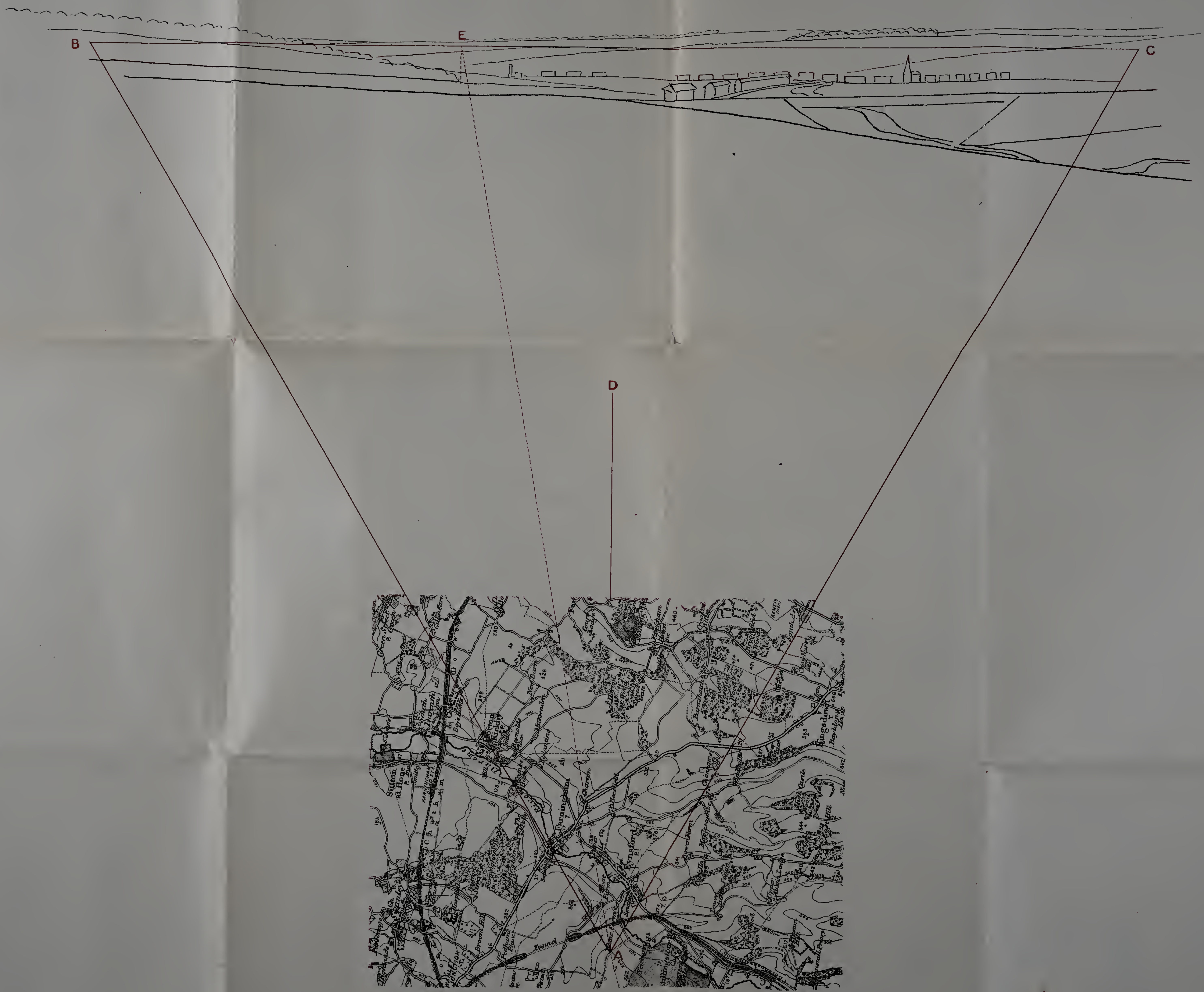


The same scale on the Service protractor.


YARDS 3 INCHES = 1 MILE
SCALE OF INCHES
HORIZL EQUIVLTS FOR 1 FT. V.I.
— SCALE OF H.E. —
CONTOURS AT 25 FT. V.I. 2" = 1 MILE
" 50 " " 1" "
" 100 " " ½" "
— RULE —
V.I. (FT.) = D (DEG.) X HOR: EQUIVTS. (YDS.) / 19.1
CONTOURS AT 20 FT. V.I. 4" = 1 MILE
— SCALE OF H.E. —
10°
5°
4°
3°
2°
1°
500
400
300
200
100
1°
2°
3°
4°
5°
6°

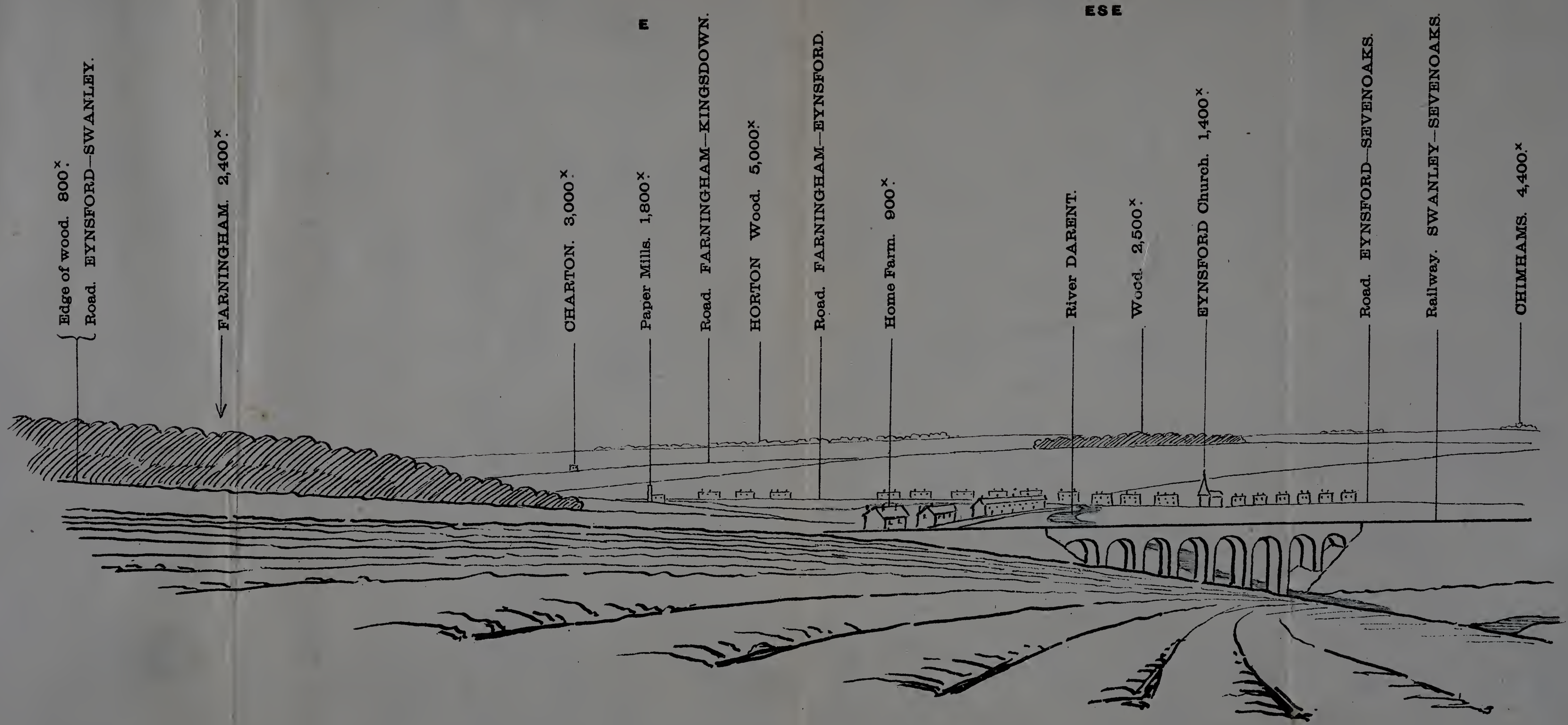
DEGS.	H.E. IN YARDS
1°	19.09
2	9.54
3	6.36
4	4.77
5	3.81
6	3.17
7	2.71
8	2.37
9	2.10
10	1.89
11	1.71
12	1.57
13	1.44
14	1.34
15	1.24
16	1.16
17	1.09
18	1.02
19	0.97
20	0.91
25	0.71
30	0.58

PLATE 2.



Reproduced from the Ordnance Survey Map, with the sanction of the Controller of H.M. Stationery Office.

PLATE 3.


E
ESE
Edge of wood. 800^{x}.
Road. EYNSFORD—SWANLEY.
FARNINGHAM. 2,400^{x}.
CHARTON. 3,000^{x}.
Paper Mills. 1,800^{x}.
Road. FARNINGHAM—KINGSDOWN.
HORTON Wood. 5,000^{x}.
Road. FARNINGHAM—EYNSFORD.
Home Farm. 900^{x}.
River DARENT.
Wood. 2,500^{x}.
EYNSFORD Church. 1,400^{x}.
Road. EYNSFORD—SEVENOAKS.
Railway. SWANLEY—SEVENOAKS.
CHIMHAMS. 4,400^{x}.

View from the "H" of Home Farm (1 inch Ordnance Map, sheet 271).

1,500^{x} West of EYNSFORD, looking East.

Ranges from the map.

Distance 12".

P.E. Lewis Capt. R.F.A.
Oct 18th 1907.